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Adjustment of superconductivity and ferromagnetism in few-layered ferromagnet-superconductor nanostructures

Izyumov Y., Khusainov M., Proshin Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The phase diagrams of few-layered nanosystems consisting of dirty superconducting (S) and ferromagnetic (F) metals are investigated within the framework of the modern theory of the proximity effect taking into account the boundary conditions. The F/S tetralayer and pentalayer are shown to have considerably richer physics than the F/S bi- and trilayer (due to the interplay between the 0 and π phase superconductivity and the 0 and π phase magnetism and nonequivalence of layers) and even the F/S superlattices. It is proven that these systems can have different critical temperatures and fields for different S layers. This predicted decoupled superconductivity is found to manifest itself in its most striking way for F/S tetralayer. It is shown that F/S/F′/S′ tetralayer is the most promising candidate for use in superconducting spin nanoelectronics. © 2006 American Institute of Physics.

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